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Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

No. 202

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NUCLEAR DEVELOPMENT AND PROLIFERATION

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RADIOACTIVE SOIL CLEANUP ONLY PARTIALLY PAID FOR BY FIRM

Sydney THE SYDNEY MORNING HERALD in English 26 Jul 83 p 5

[Article by Stephen Rice]

[Text] The State Government has decided against legal moves to force the sand mining company, Associated Minerals Consolidated Ltd, to pay the full cost of removing radioactive soil from 112 contaminated properties at Byron Bay.

The Minister for Health, Mr Brereton, announced yesterday that the company had agreed to meet half the anticipated $1 million cost of the clean-up.

The rest would be met by the State Government and the two shire councils involved, he said.

The Health Department has identified 112 properties in Byron Bay, Mooball and New Brighton affected by radioactive waste dumped during beach sandmining between 1934 and 1975.

The contamination comes from concentrations of the mineral monazite, containing radioactive thorium. Tailings from the mineral plant were offered to local people for landfill.

A private investigation early last year by Associate Professor Murray Winn of Sydney University found radiation levels around the town above the internationally accepted level of 60 microrens an hour. This was later confirmed by Health Department investigators.

Some homes had readings up to six times the accepted level.

The general manager of Associated Minerals Consolidated (AMC), Mr John McKellar, said yesterday the company, one of the world's largest producers of mineral sands did not accept liability because the company didn't distribute the material around Byron Bay.

"That was done by residents, by the council or anyone else who wanted fill," he said.

AMC also claims that most of the contamination occurred before its acquisition of the mining lease from Zircon Rutile Ltd in 1962.

Last year the State Government demanded that AMC pay the full cost of the clean-up, and said it would take joint legal action with local citizens to force AMC to fulfil its obligations. If necessary, it would pursue the matter as far as the High Court.

The legal challenge was expected to lay the ground for other environmental battles around Australia, identifying who was responsible for radioactive soil, and whether affected individuals would have grounds for suing on the basis of damage to their health.

But a spokesman for Mr Brereton said yesterday the minister had received legal advice that a court battle was likely to last several years, and the company's offer had been accepted because it would solve the problem in the shortest possible time.

It was the first time in NSW that a company had accepted financial responsibility in such a case, and this in itself was a good precedent, the spokesman said.

A number of contaminated properties, including the local hospital and school, have already been cleaned up at State Government expense.

CSO: 5100/7542

EFFICIENCY IN NUCLEAR POWER PLANT CONSTRUCTION URGED

Importance of Efficiency Analyzed

Prague HOSPODARSKE NOVINY in Slovak 20 May 83 pp 8-9

[Article by Eng Jozef Lukacka, general manager, Slovenske energeticke podniky [Slovak Power Production Enterprises], Bratislava: "Efficiency Is the Most Important Thing"]

[Text] The preparation and construction of nuclear power stations has certain specific characteristics which require special solution rather than adherence to the principles commonly followed. This conclusion has been reached not only in this country, but abroad as well. Our development of nuclear power stations is based on the VVER 440 and VVER 1000 reactors.

Czechoslovakia has a special position among the CEMA countries, since it is providing a large proportion of process equipment deliveries for the nuclear and conventional parts of nuclear power stations. Thus even though the general designer is a Soviet organization, most of the planning documentation is worked out by Czechsolvak design organizations.

A Practical Example: Mochovce

I should like to illustrate the practical problems of planning preparation through the example of the Mochovce power station. The time scope of the key discussions and decisions was as follows.

In its Decree No 221 of September 1978, the CSSR Government Presidium approved the placement of four nuclear power units in Mochovce. In November 1978 the draft of the directive general plan was approved, and in March 1979 geological surveying was begun. At the same time, the Czechoslovak Atomic Energy Commission approved the Mochovce site. But the site layout plan was not approved, because more detailed surveying was required. In November 1980 an intergovernmental agreement between Czechoslovakia and the Soviet Union for construction of the power plant was signed. In October 1981 a contract for revision of the technical plan to meet the conditions of the Mochovce site was signed. The deadline for delivery of this plan was to be 1 August 1982.

During design preparation, major difficulties were encountered in connection with property rights on the construction site, the taking of agricultural land, protracted work on drawing agricultural agreements, and arbitration. The stepped-up requirements regarding the scope of investor preparation (the network charts, conditions of work, studies of the rate of construction progress and the like), together with allowances for investment limitations and the efforts of the contractors, results in an unfavorable division of the Mochovce project into six independent construction projects. In an attempt to speed up preparations, some projects were further subdivided, which complicated the process.

The preplanning work and planning preparation were carried out under the following schedule;

--an updated investment concept for the site outside the settlement of Mochovce was presented on 19 June 1978;

--the data for undating the 1978 investment concept to fit the site were approved by the Czechoslovak Atomic Energy Commission in May 1979;

--the Study of the Set of Construction Projects was drafted in January 1980 and approved by the State Expert Commission in December 1980. Other work also proceeded in accordance with the established schedule.

In spite of the complex organization of the project, the investor, the general designer and several suppliers carried out their preparations in a third or less of the time required by the procedure specified by regulations and notices currently in use in capital construction.

Special circumstances of the construction of nuclear power stations which arise during their preparation and realization are resolved by decrees of the CSSR Government Presidium, the Councils of Ministers and the like; nonetheless, the specific characteristics of the preparation and realization of nuclear power stations not provided for in Notice No 105/1981 of the Code should be included in a special decree of the Federal Ministry for Technological and Investment Development [FMTIR]. This decree should make the entire reproduction process faster.

Price Trends

In addition, there are interesting price trends in the area of capital construction. I would like to illustrate this problem with respect to the construction of the V-2 power station at Jaslovske Bohunice.

The construction of the V-2 station involves the same capacity as that of the V-1, i.e., 2 X 440 MW, but with a higher level of safety. The investment expenditures approved under titles II through VII were 24 percent higher than those for the V-1 in the planning assignment and summary plan. During construction, it turned out that the approved expenditure levels did not express the real state of affairs, and that expenditures had been increased by changes in the technical design and the scope of equipment additions

to the V-2 stations (which resulted in a higher level of nuclear safety than in the V-1), by a changeover from foreign deliveries in the case of the V-1 station to domestic deliveries for the V-2 station, and by increased costs for materials on world markets, among other things. As an example, I show in Table 1 the increase in prices of certain types of equipment for the V-2 station compared to those for the V-1.

The situation is similar in the case of construction work; the scope of construction work and the range of performance technologies increased, particularly as a result of requirements involving the sealed zone of the main power production unit.

There was a considerable expansion in electrical engineering facilities, facilities for delivery and treatment of process water, the machine room and the engineering infrastructure. Under the "Reactor Room" heading there was an increase in the amount of steel structural members, increased facing of walls with sheet steel, and increased number of built-in components.

The total increase in investment expenditures compared with the V-1 will thus exceed 100 percent. According to available information, the increases in budget expenditures in the Soviet Union and East Germany also exceed 100 percent.

Table 1. Increase in Prices of Selected Equipment for the V-2 Station Compared to the V-1.

Equipment	Increase, Percent
Reactor pressure vessel	92
Main circulating pump	98
Steam generator	122
Main circulation piping	343
Volume compensator	65
Fueling machine	295
Reactor room crane	118

Delays Cause Harm

Where efficiency is concerned, the most important matter is that of keeping to the construction schedule, or in other words, putting the station into operation on time. The preparation and construction of the first unit of the V-1, including its commissioning, lasted not quite 8 years--71 months from the beginning of the excavation for the main power production unit--which is very good in terms of worldwide experience. The beginning of preparations for and construction of the V-2 can be dated from the CSSR State Government Presidium Decision No 197 of 10 July 1975. According to this decrease, the construction was to be carried out as a repeat of the plans for the V-1 station. According to CSSR Government Devree No 85 of 29 April 1976, however, it was decided that the construction of the V-2 power station should incorporate a higher level of nuclear safety, using

the V-213, reactor and a bubbler system for localizing accidents, which led to a certain slowing of construction. Currently, the final installation work is under way on the first unit of the V-2 station, while the construction work is gradually being brought to a conclusion and installation work is under way on the main power production facility of unit No 2.

Experience with nuclear power station construction in Czechoslovakia confirms that there is real potential for decreasing construction time. Major significance is also attached to constructing nuclear power stations on schedule abroad. In the United States, for example, the average expenditure resulting from a delayed startup of a single reactor unit with a capacity on the order of 1,000 MW is estiamted to be $1 million a day.

The current efficiency of operation of nuclear power stations can be determined, with some oversimplification, from a comparison of the total in-house expenditures of nuclear and conventional power stations for the delivery of electric power. For comparison with the V-1 we may consider the Novaky B station of the Slovenski energeticke podniky [Slovak Power Production Enterprises] concern, which has 11--MW units burning local brown coal (See Table 2).

Table 2. Comparison expenses for production of electricity in conventional and nuclear power stations.

Expenditures at Novaky B power station, halers per kWh

	Total	Fuel
1981	29.3	15.0
1982	32.7	15.2

Expenditures at V-1 nuclear power station, halers per kWh

	Total	Fuel
1981	14.5	5.9
1982	13.6	5.0

When nuclear power stations are built in the CEMA countries, the abilities of the individual countries to participate in investment prepration and equipment production play an important role. Czechoslovakia is one of the main producers of the most important components for the nuclear parts of the stations as well as the process equipment for the conventional parts. The participation of Czechoslovak production organizations in provision of process equipment is based on multilateral agreements on specialization of production and delivery of equipment for VVER 440 and VVER 1000 nuclear power stations to be built in the CEMA countries during 1981-1990. The importance of the resulting tasks for the Czechoslovak national economy was emphasized in the draft State Special Program No 01, Development of a Nuclear Power Complex.

Significant Incidental Benefits

A new component of the program for construction of nuclear power stations is the use of their heating purposes. Nearby cities will be provided with heat by means of long-distance heat mains.

A further opportunity for economy consists in using the waste heat from nuclear power plants' cooling water to intensify large-scale agricultural production and large-area thermal land reclamation. The design conception and operating specifications guarantee stable year-round delivery of waste heat from the cooling water.

The results which we will realize from the multipurpose use of heat are indicated by the fact that, for example, the efficiency of utilization of the 2,750 MWt thermal output of the V-1 reactor, which produces an electrical output of 860 MWe, is 31 percent. With combined production of electric power and heat for a centralized system of heat supply to surrounding locations, the efficiency of the nuclear power station would increase to 46 percent. With comprehensive use in the domestic and municipal area, in industry and in large-scale agriculture, efficiency may reach 52 to 64 percent, i.e., twice as high as the present value. According to the proposed design for the secondary circuit of the station at Mochovce (eight 220-MWe turbines), we may realistically consider an overall output of 1,020 to 1,260 MWt with production of hot water at 180°/60° C.

The municipal and industrial consumption of heat from the Mochovce station could reach 700 MWt, and therefore further use of the heat output to meet the energy needs of expansion of agriculture and the food industry complex is being proposed. In addition, in this agriculturally valuable area there is also the possibility of large-area use of low-level heat from cooling circuit water to intensify crop production and for warm-water fish raising.

The ecological aspects and the effects of various types of energy sources on human health are extremely important in connection with the development of nuclear power. All investigations have come to the conclusion that the risks of nuclear energy are no higher than those from burning coal or oil. The development of the nuclear power complex in Czechoslovakia is an economic necessity, and we must carry out the development program by building nuclear power plants more quickly. It is also important that ecological and social problems continue to be taken into account in rationalizing the construction and operation of nuclear power stations, since they are inseparable preconditions of all the criteria involved.

Faster, Cheaper Construction Methods Examined

Prague HOSPODARSKE NOVINY in Czech 20 May 83 pp 8, 9

[Article by Dr of Natural Sciences Miroslav Cihlar and Eng Zdenek Chalus, CSc, Research Institute of Above-Ground Construction, Prague; Eng Jan Svoboda, Institute of Construction Rationalization, Prague; and Eng Rostislav Havlicek: "How to Accelerate Production and Reduce Costs"]

[Text] Building a nuclear power station involves the construction of an extensive complex of installations. They include not only the power station itself, but many directly related and accessory investment projects. The construction process takes in hundreds of organizations, which can be divided into two large groups, i.e., nuclear equipment and nuclear construction; correspondingly, in this country there are two general contractors, for machinery and for construction.

A Worldwide Trend

Worldwide development is slower than expected. The main problem is that construction costs are increasing, and power stations are more expensive than they should be according to plans. Their construction is stretching out, leading to incorrect estimates of final cost. They are becoming risky investments. The extension of the construction time required from 6 years to 12 and the rise in actual procurement costs by a factor of 3.7 from initial budget figures are the main reasons for a slowing of the pace of implementation of the nuclear program in the United States. The number of standards used in the design and construction of nuclear power plants in the United States increased from 100 in 1970 to about 1,700 in 1976. Their application resulted in roughly doubled consumption of concrete, steel, piping, cables, double the number of workers on site, and a considerable stretching out of preparation work and construction time.

France is being more successful: the index quoted there is 1.67. Why is this? It is primarily because of consistent standardization of two main series of nuclear power stations, using light water reactors with capacities of 900 and 1,300 MWe. The standardization of this program made it possible to considerably cut back license management and greatly shorten construction time. Series production of the equipment makes it possible to decrease procurement costs in spite of heightened safety requirements. But increases stemming from inflation and exchange rates have fully manifested themselves in France as well.

Even in the capitalist countries, the program of consistent standardization of the technical design of the nuclear program, including standardization of the relevant construction technologies, is coming to be one of the ways of dealing with economically unfavorable developments.

In the Soviet Union too, the standardization program is intended to cut construction times and decrease construction costs. The strategy of flow-through construction adopted in the Soviet Union calls for the use of a uniform project design based on the Zaporozh'ye station and the VVER 1000 reactor. This standard type will be built in both the Soviet Union and the other CEMA countries for several years.

What is "standardization of nuclear power stations"? What are "standard construction technologies"?

First, we can see even now that a project which has not been implemented and tested in practice cannot be considered standard, since it has not proved

itself in operation. Nor can we consider a plan which does not involve identical equipment to be standard. In the complex system of a nuclear power station, the resolution of details has a particularly great effect. Each change produces problems. Therefore, in order to deal with the problems of unavoidable changes (during planning and construction) in standardized construction projects, the initial standard plan must be approached with a certain conservatism. But we must not overdo it, for excessive conservatism leads to excessive increases in expenditures without yielding any benefits. Thus the correct degree of conservatism is also a measure of the economic justification for nuclear power stations.

Nuclear Power Stations in Czechoslovakia

Increased budget expenditures also accompany the construction of nuclear power stations in Czechoslovakia. If we assume a 25-year lifetime for coal-fired power stations and a requirement to maintain current installed power production capacity, by the year 2007 we will have to commission nuclear power stations with a total capacity of 15,000 MWe, i.e., 12 VVER 440 units and 12 VVER 1000 units. During this period the center of gravity will, in fact, shift considerably toward electricity produced in nuclear stations, whether we like it or not. The question is how we will provide them.

The Soviet uniform plan for power stations with VVER 1000 reactors solves the problems of levels of work required on the construction site and of smooth construction and smooth commissioning of nuclear power stations. It was drafted by the Teploelektroproyekt Institute. It includes:

--organization of flow-through methods of construction of power production units;

--network models of construction and installation work;

--process charts for the various special types of work;

--lists of construction machinery and mechanisms;

--data for material and equipment support of construction;

--data for installation of process equipment;

--a management system.

It is up to us what kind of model system we develop from this plan for our own specific conditions.

Construction work has a considerable share in the increase in costs of nuclear power plants. For example, the structures accounted for 16.53 percent of the total increase in cost of the V-2 power station compared with the V-1, while the operating sets accounted for 37.43 percent. The increase in costs for the construction work was more rapid: the price increase index for construction of the structures was 2.22 and that for the operating sets was

2.03. More than half of the increase in the cost of the structures came from the construction of the reactor, partly as a result of increased nuclear safety requirements, which led to a considerable increase in the amount of construction work needed.

Expenditures on Nuclear Power Plants (Kcs 1 million per MWe of net output)

Location	Power MWe	Initial Year	Budget Portion	Revised Year	Budget Portion	Remarks
Jaslovske Bohunice (V-1)	2x440	1970	6.60	1981	8.77*	* Actual
Jaslovske Bohuncie (V-2)	2x440	1975	8.57	1982	20.75*	* Calculation not yet approved
Dokovany	2x440	1977	11.92	1983	21-22*	* Estimated
Mochovce	2x440	--	--	1983	24-25*	* Estimated
Temelin	4x1000	1981	14.10	1983	18-21*	* Estimated

Note: While the specific budget expenditures for the V-1 station were on essentially the same level as those for the latest coal-fired stations of the time, i.e., Kcs 7.96 million per MW for Melnik III (1x500 MW), and Kcs 9.47 million per MW for Prunerov II (5x210 MW), the expenditures for subsequent nuclear power stations have been significantly higher.

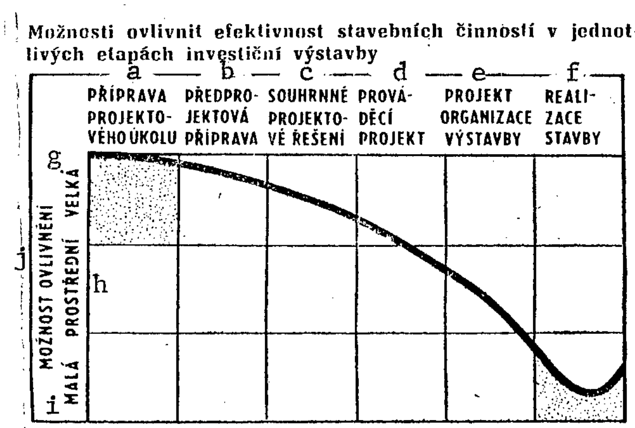
In addition, we must be aware that the costs presented in the table by no means include all of the expenditures required to bring a nuclear power station into existence. All related investments and housing for employees must be built in timely fashion and with the requisite quality. Even here, "construction" by Czechoslovak precedures is the critical factor. Thus the investment intensity of nuclear power production stemming from increases in budget expenditures is ultimately becoming the most important limiting factor of its development.

Even if ultimately we somehow succeed in mastering the required program for construction of nuclear power stations during this period, the question of how much the nuclear power stations will cost us is not a matter of indifference. The more money we must invest in them, the less will remain for other projects in industry and the more difficult it will be to keep pace with the rest of the world in developing our national economy as a whole and to meet the needs of the populace. Accordingly, like the other countries of the world, we too must strive to reduce the cost of such projects. The way to do this is scientific and technical progress, a standardization program worked out for the specific characteristics of Czechoslovak practice (or changes in these practices).

The construction of the VVER 440's now under way represents an immense laboratory in which we may determine which construction technologies have justified themselves and which require further improvement. Of course, this presupposes systematic analysis, not only of the power stations currently under construction, but also of future, higher power ones.

The fact that Soviet Union is delivering the plans for all the special facilities is no excuse for us. We must provide the Soviet designer in timely fashion with tested technologies which have justified themselves under our conditions, and precise economic and technical calculations for proposed changes. Like us, the Soviet designer aims at building less expensively, using scarce materials sparingly, and shortening construction time. He is answerable for nuclear safety and for the overall effectiveness of the undertaking. Therefore, changes in technology must be properly supported with documentation and the time required to work them into the plan must be available. Hitherto we have developed very little initiative in this area; but in East Germany the Institute of Industrial Construction under the GDR Construction Academy and Teploproyekt in Moscow have jointly developed and put into production the so-called "Stahlzelle" [steel cell] prefabricated formwork which makes use of the physical properties of steel and concrete to advantage and build on prior experience with compositer and combined structural components in East Germany. Cooperation with the Soviet Union in the area of construction preparations before the signing of a contract for the specific siting of a nuclear power station is almost nonexistent in this country. As Figure 1 shows, the greatest effect can be achieved in the area of good preparation for our own construction and installation work; but our experience corresponds to the right side of the curve. In contrast to the nuclear machinery industry, the builders still have no organization capable of comprehensively solving the problems of nuclear power plant construction with personal responsibility for making decisions and putting the results into practice on site.

Figure 1. Possibility of affecting the efficiency of construction activity at various stages of capital construction.



(see Key on next page)

Key:

a. Preparation of planning assignment
b. Preplanning preparation
c. Comprehensive project design
d. Working plans
e. Construction organization plan
f. Peformance of construction
g. Large
h. Medium
i. Small
j. Potential effect

Technical Progress and Expenditures

Our Energoprojekt Organization, the general designer of all nuclear power stations, has long been involved with budget expenditures and the overall construction of power stations, both conventional and nuclear.

Analysis of this information makes it clear that in addition to long-term worldwide trends, which actually did not fully affect our previous construction work, enormous increases in prices are resulting from certain particular circumstances. For example, a change in suppliers, and thus a change in the wall design of special facilities (reinforcing formwork units for VVER 440 nuclear power stations) has increased the prices for the steel structural members alone from Kcs 15 per kilogram including installation (Hydrostav Bratislava) to Kcs 22 per kilogram without installation (producers in the Federal Ministry of Metallurgy and Heavy Engineering [FMTIR]). The total increase in the cost of the V-2 station resulting from this factor is Kcs 107 million.

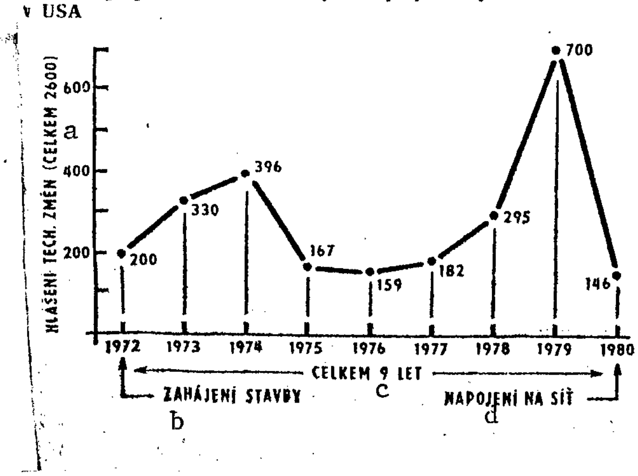
It is generally known, even from popular television programs, what extraordinary efforts the top-level organs must make, for example, to assure enough welders. The extra expenditures resulting from such ad hoc interventions show up even in the final balance sheet for the project. The problems with reinforcing formwork and the corresponding welding capacities are not the only ones; the preparation and management of the construction with and construction and installation technology are critical. Here is where the origins and causes of mahy of our difficulties are to be found.

One way of casting light on the seemingly insoluble tangle of relationships and ties between the participants and the demanding technical design of the undertaking is planning with physical models. The models are made of plexiglass. They are extremely suitable both for varying the deisgn in order to optimize piping systems, cables, passageways and the like, and for taking account of the specific local characteristics while using standard facilities. The construction model can be used to test ways of optimizing installation procedures, stockpiles of construction and process materials during the various phases of construction and the like. It is here that technical development could play the decisive role: based on our experience with construction in connection with the Soviet plan, we could create a

model system for the construction of our nuclear power stations with VVER 440 and VVER 1000 reactors; we could categorize and work out in advance construction and installation technologies for our conditions and purposes, and design and prepare a physical model of a standard type. In any case, we will be building nuclear power stations with VVER 1000 reactors for more than 20 years. This is long enough go for the advantages of model-based planning to be sufficiently realized. The conception is a tested one; experience with it in the France and the United States has been very good. For example, the Tennessee Valley Authority (TVA) uses two models, a planning model and a construction model, in each individual project. The construction organization plan, and with it the schedule, are developed only after the local coordination of equipment contractors and construction contractors have been tested on the models and after any errors in planning have been found. Previously, technical changes in the course of construction had reached a totally unbearable extreme (Fig. 2). In this case, model planning and computer representation during planning became a very valuable aid for all participants in construction. France is using the advantages of model planning in both of its standard types of nuclear power stations.

Figure 2. Graph of announcements of technical changes during the construction of the Sequoyah nuclear power plant, presented by TVA in support of the decision to use new methods for planning, preparation and management of the construction of nuclear power stations in the United States.

Obr. 2
Přehled hlášení technických změn v průběhu výstavby jaderné elektrárny Sequoyah, které společnost TVA uvádí na podporu rozhodnutí používat nových metod pro projektování, přípravu a řízení výstavby jaderných elektráren v USA



Key:

a. Announcements of technical changes (total 2,600)
b. Beginning of construction
c. Nine years total
d. Connection to power grid

The road ahead involves many kinds of savings as a result of technical and organizational innovations. Naturally, the model system must be open to innovation, and the degree of innovation must agree with the degree of conservatism of the standard design. We have already done some work of this kind in the nuclear construction field within the context of the current structure of R&D work. We are working on replacing the welded joints reinforcing formwork with nonwelded joints, and using higher strength reinforcing steel and new construction technologies such as reinforcing-bar gratings, disassembled reinforcing formwork units and the like. Because of the real, rapid cooperation between research and planning, some R&D results have already been worked into the design for the spent fuel storage facility, which is being entirely designed by Czechoslovakia.

Ways of Correcting the Situation

The shortcomings in construction of nuclear power stations have not merely been criticized at specialist seminars and on public broadcasts. Ways of preventing shortcomings in future construction are being sought, among other things by concentrating the construction organizations under a single organization (or VHJ). This measure promises optimal use of the experience of both the technician and the skilled worker, including the use of machinery. Unfortunately, Energoprojekt's analysis mentioned above shows rather unambiguously that specialization and monopolization have hitherto led only to increased costs. Neither has the development of individual specializations in accordance with the views of the plants involved in the construction of the cooling towers been without problems. Considerable difficulties have arisen in synchronizing construction so that these specialized capacities can be optimally used in the flow-through method. These difficulties would multiply in a single-purpose VHJ.

Foreign experience shows clearly that the most effective approach is optimal utilization of technical progress and speeding the process between research and its utilization. Why take extraordinary steps to transfer and concentrate welders? Instead of these expensive, toilsome measures, why not concentrate the engineers in order to limit or, in some cases, eliminate welding work?

We have long-standing, even if not extremely broad, experience with the construction of nuclear power stations. On the sites and in the organizations dealing with scientific and technical development there have developed a number of experienced workers, some of whom have foreign experience from travel and temporary assignments. Experience has shown that teamwork has arisen by chance, more by friendly relations between individual workers than in the context of officially introduced and rather stiff organizational structures. None of the organizations engaged in R&D in nuclear construction has enough manpower to solve all aspects of the problem. Connections which could rapidly and effectively affect the research-development-construction-operation cycle are lacking. It is assuredly easier to orient the R&D base to working out the construction of nuclear power stations than to reorganize immense construction organizations.

As a relatively closed system, the nuclear construction industry is especially well suited to the use of matrix forms of R&D management. As we have tried to indicate, they are a necessary condition for optimal use of technical progress and progressive forms of organizing the preparation and management of construction projects, and thus for avoiding enormous increases in construction costs and the stretching out of construction.

8480
CSO: 5100/3028

TREATMENT OF RADIOACTIVE WASTES BY CALCINATION DISCUSSED

Prague JADERNA ENERGIE in Czech No 4, 1983 pp 145-147

[Article by Pavel Ditl and Jiri Jecmen (Mechanical Engineering Faculty, Czechoslovak Advanced Technical School, Prague), and Jiri Napravnik and Leo Neumann, Institute of Nuclear Research, Rez: "Processing of Liquid Radioactive Wastes by Calcination, Part 2, Machinery for Calcination of Radioactive Wastes"]

[Text] This article is a sequel to Part 1 [1]. It discusses selected equipment for calcination of radioactive wastes (RAO). Based on semiproduction scale tests, we designed and conducted functional tests of equipment for denitration and calcination of radioactive solutions, which was in trial nonradioactive operation for 1,200 hours and produced calcinate in a form suitable for further processing. The functional tests were successful, and the equipment was also successful in the processing of actual radioactive wastes at the Jaslovake Bohunice station.

It is natural to try to develop a modular system of machinery which would be as universal as possible, for we may expect that wastes of different composition will be handled by different processes. Accordingly, we imposed a system approach on our selection of process requirements, specified the main devices and selected devices of the most universal type possible for the realization of the technology. This article considers only the main process equipment; auxiliary equipment, batching, material transport, handling of gases and questions of regulation will not be discussed. In all process types, we assume preconcentration of the radioactive wastes from about 5-80 kg/m^3 to about 200-500 kg/m^3. In machinery terms, this problem is solved by the use of one-level circulating evaporation, which has already proven itself on the production scale [2].

Another type of equipment which appears in all processes is a device for denitration or other chemical treatment of the concentrated radioactive waste. For this purpose we designed an intermittently charged reaction vessel with a fast stirring unit. The vessel is heated (and may be cooled) by a jacket. Stirring improves heat exchange between the charge and the jacket, brings the phases into contact, stirs up the solid phase (e.g., SiO_2 or Fe) if it is

present, and speeds up the reaction kinetics by increasing the interphase surface area or by better removal of the reaction products from the area of phase contact. The stirrers are designed and selected in terms of the main desired effect of the stirring. If the stirring is intended primarily to stir up the solid phase in a low-visosity liquid phase, then axial stirrers are most often chosen (Figure 1a): e.g., three-bladed (ON 69 1025a), four-bladed or six-bladed (ON 69 1020) stirrers with the blades inclined at an angle of 45°. The diameter of the stirrer is chosen so that the ratio of the interior diameter of the reaction vessel to the diameter of the stirrer (D/d) is approximately 3. The stirrer is mounted in the vessel in such a way that the lower edges of the blades are at a distance from the bottom equal to about 2/3 to 1 times the stirrer diameter. The height of the liquid in the vessel is approximately equal to the diameter of the vessel. The walls of the vessel are provided with four baffles of width equal to 0.1 times the diameter of the vessel in order to suppress the central vortex. The rotary speed of the stirrer is chosen to assure reliable stirring up of the solid phase is presented in Ref. 3. While the vessel output is being increased to a first approximation, the condition which applies is that the power dissipated by the stirrer per unit volume of charge is constant. From this condition we obtain the modeling condition:

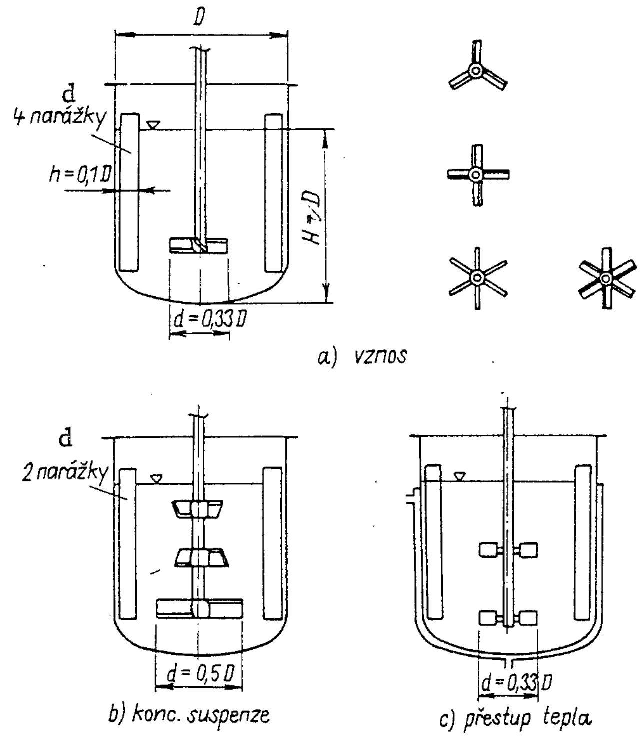
$$n_f \cdot d^{0.66} \simeq \text{const},$$

where n_f is the rotary speed required to raise the solid phase and d is the radius of the stirrer. In stirring of highly concentrated fine suspensions, when the charge has non-Newtonian rheological behavior, it is best to use a high-speed stirrer (Figure 1b), and for modeling we have the condition [3]

$$nd^{0.86-0.93} = \text{const}.$$

If the critical mechanism is heat transfer, we choose a radial stirrer, either a turbine stirrer with a separator ring (ON 69 1021) or sometimes a turbine stirrer with flat blades (Figure 1c). Otherwise the geometrical arrangement of the system is practically the same as was described for the axial stirrers. If the manipulation space above the vessel is increased, it is also possible to use an eccentric stirrer arrangement without the baffles or with a non-standard baffle. It is advisable to introduce reactive or dispersed components below the stirrer.

The reaction vessel operates intermittently, which is unfavorable, because it is usually located between two units operating continuously. A certain advantage of this arrangement is the creation of a material capacity to absorb breakdowns and differences in the capacities of the continuous equipment. But since the reactor contains radioactive material, it is inadvisable to accumulate it in a relatively large amount. Thus we may expect that further development will take the route of creating continuous reaction vessels in which the mixing effect is provided, for example, by static mixers, particularly in the case of highly radioactive wastes. But the solution of the problem requires, among other things, complete mastery of a technique for precise dosing of the components. For the reasons described, when the charge reaction vessel is used, we try to choose the smallest possible volume which will assure smooth preparation of the radioactive wastes for subsequent processing when the device is installed between two reactors operating in parallel.



Obr. 1. Vhodné typy míchadel a míchacích zařízení

Figure 1. Suitable types of stirrers and stirring devices

Key:

a. Stirring up of solids
b. Concentration of suspension
c. Heat transfer
d. Baffles

Another type of equipment used in the technology described is a device for evaporating water from a chemically treated solution. When processing radioactive wastes for fixation by vitrification, this device must also break down the nitrates and produce a calcinate in a particulate form which meets the conditions for operation of the vitrification unit. For bituminization purposes, standard film evaporation has been successfully tested under experimental conditions [2] and used in production [2]; the feed solution is wiped along the wall by four blades on a rotating shaft. The gap between the blades and the heat-exchange surface is about 1mm, and the circumferential speed of the blades is about 3-5 m/sec.

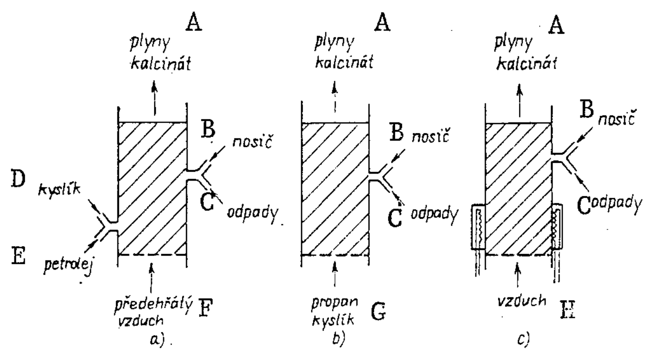
In designing calcination equipment, we had to decide between fluid drying and a calcinator operating on the principle of the evaporation devices. We carried out a mathematical analysis of the conditions and capabilities of fluid drying [4]. The analysis was based on data obtained in the United States [5].

We used calculations to compare the advantages and disadvantages of fluid bed calcination (Figure 2, a, g, c), using:

(a) fluid layer with combustion of a petroleum-oxygen mixture, fed beneath the grate;

(b) a fluid layer with combustion of a propane-oxygen mixture fed from below the grate;

(c) transfer of heat to the fluid bed from walls internally heated by electricity.



Obr. 2. Schematické znázornění pauzovaných případů kalcinace ve fluidním loži

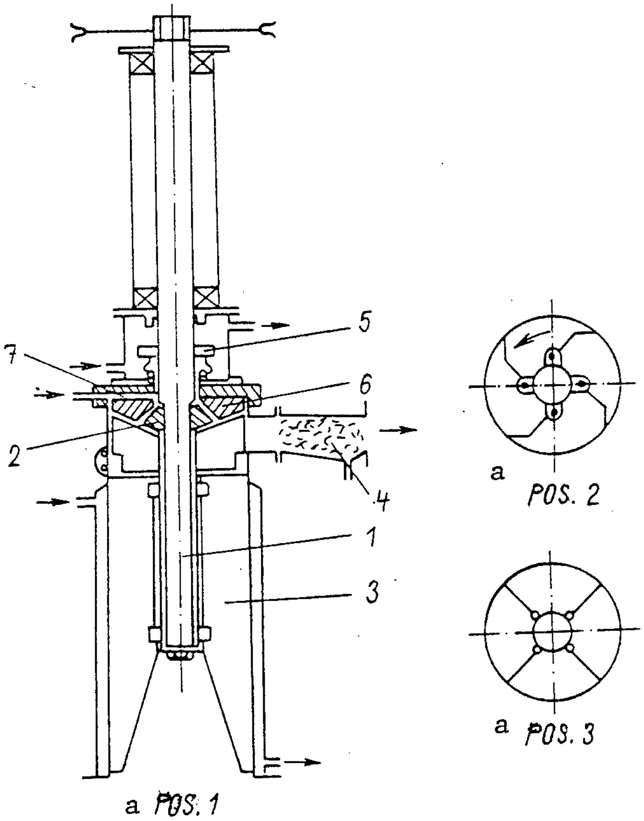
Figure 2. Schematic representation of the cases of fluid bed calcination considered.

Key:

A. Gases and calcinate	E. Petroleum
B. Carrier	F. Preheated air
C. Wastes	G. Propane and oxygen
D. Oxygen	H. Air

Calculations of the dynamic behavior of the fluid layer indicated the conditions which would result in fluctuation of the layer, which then leads to a labile state and interruption of the process. We selected two technically acceptable variants for possible study, that is, a design with electrical heating of the walls as shown in Figure 2c, and a design with heating by a mixture of propane and air (or propane and oxygen) fed from beneath the grate (Figure 2b), which would have a pressure loss approximately the same as that of the proposed fluid layer. A disadvantage of this design is the escape of the fine fraction of the resulting calcinate as dust, which requires a powerful separator, and the possibility of occurrence of a labile state if the parameters were not suitably chosen and set.

Accordingly, we gave preference to the method in which removal of the water phase and calcination take place in a device whose design is based on the principle of film evaporation.



Obr. 3. Vertikální odpařovací zařízení s letmým uložením hřídele

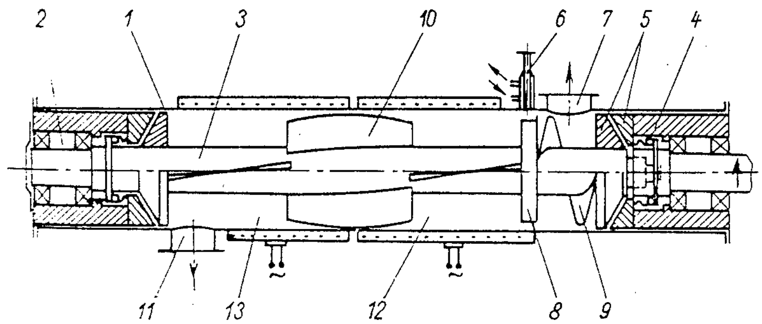
Figure 3. Vertical evaporator with flying shaft arrangement

The first variant of the design (Figure 3) is similar to ordinary film evaporation. The lower bearing of the rotating shaft, originally located in the evaporation space, was eliminated and replaced by an arrangement [6] in which the shaft rests in bearings located outside the working space. This design eliminates scoring of the bearing and failures resulting from the presence of solid crystalline phase in the product which surrounds the bearing. The device operates in a basic vertical position. But we also considered that inclining it relative to the vertical axis would make it possible to keep the calcinate in the device for long enough to achieve the desired drying and breakdown of the nitrates. Obviously, this device could be used advantageously for bituminization.

The upper part of the device shown in Figure 3 is formed by shaft 1 in its bearings, while the lower half consists of the evaporating device, into which fits the shaft, equipped with four blades which either wipe along the wall (view 2) or are fixed (view 3). The machinery (nonradioactive) is separated from the process section (radioactive) by a mechanical gland 5, which is water-cooled. The negative effects of radiation on the material of the gland and bearings is decreased by lead shielding, 6, whose effect is supplemented by a lead apron fixed to the shaft. Slot 7 between the shielding components make it possible to remove the radioactivity by a steam blast.

The solution to be evaporated is fed tangentially into the top inside edge of the heated surface. The concentrated solution exits at the bottom and the vapors at the top, through a wire mesh dust filter 4. The steam heating method which we chose may be replaced or supplemented by electrical heating.

The device described has not, however, been tested in operation, because it was not possible to get it produced.



Obr. 4. Schéma horizontálního uložení kalcinátoru

Figure 4. Horizontal layout of calcinator

We gradually developed an additional type of calcination unit operating in the horizontal position [7] (see Figure 4). This type transports the calcinate by a system of blades which are slightly inclined relative to the shaft axis. The device consists of a cylindrical shell 1 at both ends of which are the seats 2 for shaft 3. The seating area is separated from the working (process) area by mechanical glands 4 cooled with water. They are protected against radiation by shielding 5.

The solution to be calcined arrives through connector 6, which may be cooled with water in order to prevent growth of incrustations due to premature evaporation. The feed solution is prevented from short-circuiting through vapor outlet 7 by disk 8. Wormscrew 9 separates drops from the vapor. The solution is held on the walls by the centrifugal action of blades 10, which also scrape off the dried calcinate from the heated walls. The calcinate falls out through opening 11.

Since it is desirable to adapt the thermal power input and temperature to the process conditions for evaporation, denitration and calcination, the heating is divided into at least two sections. Evaporation section 12 is best heated to a low temperature with a large influx of steam, while denitration and calcination sections 13, which require temperatures up to 450°C, must be electrically heated. The heat consumption in this section is small.

This type of calcinator underwent functional tests in a modified device of similar type. But the glands were made of asbestos. A device with a capacity of 0.010 m^3 of radioactive solution per hour was in operation for 1,200 hours and the following main findings were obtained [8]:

a. The optimal operating conditions in terms of the quality and subsequent processing of the calcinate were established. At a feed rate of up to 0.010 m^3/hour, the rotary speed was optimized at 500 rpm. At lower speeds the calcinate was of poor quality: it dropped off in pieces with a large content of nitrate and water. At higher rotary speeds, the calcinate formed lumps and dust.

b. The operating temperatures for denitration and calcination were set at 250° and 450°C.

c. Continuous operation of the equipment must be assured. Interruptions (cessation of flow, loss of heating and the like) have a negative effect on the quality of the product and promote the formation of incrustations.

d. The rotor which we describe fully justified itself and produced fine-grained calcinate (the most frequent particle size was between 0.05 and 0.2mm), which is a prerequisite for vitrification. There was minimum dust in the vapors.

Based on these successful tests, we designed a horizontal calcinator capable of processing 10 liters of radioactive waste per hour in several variants, which differed in terms of the method of heating and the gland system. We developed a complete blueprint documentation for the basic type of horizontal calcinator with a heated surface of 0.33 m^2, assuming a minimal capacity of 10 liters of processed radioactive solution per hour.

The equipment for solidification of radioactive wastes is based on proven principles for design of apparatus used in the chemical, foods and consumer goods industries. When they are used to process radioactive wastes, account must be taken of the special nature of the material and the safety and decontamination requirements. The device shown in Figure 4 has proven to be extremely promising and widely applicable in tests and in operation; it may be used in several variants, for processing both highly radioactive wastes and wastes from nuclear power stations.

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8480
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NUCLEAR DEVELOPMENT, PROBLEMS DESCRIBED

Warsaw ZYCIE WARSZAWY in Polish 5 Aug 83 pp 3, 6

[Interview with Dr. Mieczyslaw Sowinski, Chairman of the State Atomic Energy by Janina Paradowska of ZYCIE WARSZAWY: "At the Beginning Was 'EWA' [Polish for 'Eve']"; date and place not specified.]

[Question] The State Atomic Energy was created by a decree of February 1982, an event which caused great controversy. Proliferation of central agencies is not popular nowadays.

[Answer] What is unpopular is not always unnecessary. In this case, it was indispensable. Here, we are dealing with an extremely complex field of science and technology. On the one hand, it brings society many benefits, but on the other hand, there is a serious threat if it is used improperly, contrary to principles of nuclear radiation safety. So we do need an independent state administration to supervise this area, have the appropriate expertise to create and carry out formal and legal regulations. It should strike a balance between what the public expects primarily in terms of safety and the economic realities. Different nations have adopted different solutions in this area depending on their governmental structures, but, as a rule, such independent administrations are created to deal with the nuclear field. In Poland a Government Plenipotentiary Office existed since 1957 that was later replaced by the Atomic Energy Office. Until the 1970's this activity concentrated in the former Ministry of Power, Engineering and Atomic Energy, and the Plenipotentiary Office remained marginal. It should be stressed that, as far as applications of nuclear technology are concered, we are an advanced nation.

[Question] The prevailing opinion is that we are rather backward, not advanced.

[Answer] Tens of thousands of nuclear-equipped installations used in the day-to-day operation of industry and medicine, and as many isotope, fire-control sensors, installed in factories, hospitals and museums--is that only a little? All these involve health and safety hazards. Our reactors meet half of the nation's need for isotopes, and we manufacture nuclear devices of high quality.

[Question] Let's talk about production a little later. I am perplexed by some media reports that the task of the Atomics Agency is to develop Polish model of a nuclear industry. Do we really need such a special model? It seems to me that development would be enough.

[Answer] I agree. The decree of 28 February 1982 charges us with a great number of important tasks, but these do not include developing a model for the nuclear industry. I do not think such a model exists or could be developed, because it is irrelevant.

[Question] And what is relevant?

[Answer] First of all, straightening out the entire sphere of formal and legal regulations. The basic technological problems of wider use of nuclear energy have been, or are being, solved. Yet, we are one of the last nations which has such a developed technology and yet lacks, for instance, nuclear regulation. All neighboring countries have regulated this area for a long time. This is in part of an aspect of the question as to the reason for creating the State Atomics Agency, becuase it is our task to prepare laws regulating important and basic aspects. This involves such issues as production, storage and use of fissionable and radioactive materials, location and creation of special conditions for nuclear facilities (such as power and heat plants), responsibilities of the individual ministries, liabilities for damages, and control. The draft nuclear law which we have been busy developing since September 1982 is currently in the process of interministerial discussion, and we envisage presenting it to the government in the fourth quarter of 1983. I may add that it is a quite complicated document that contains not only the general principles written into nuclear law, but also a set of draft decisions on implementation that are intended to guarantee large-scale use of nuclear energy in a safe way.

[Question] Is it at all possible to guarantee complete safety by legal regulation?

[Answer] The word "guarantee" has, of course, a relative meaning. Let us say that the goal is to reduce hazards to a minimum, and this is possible provided that there exists a proper system of personnel training, definition of the liabilities for builders, operators and maintenance personnel of nuclear facilities. It is a fact of nuclear technology--as proved by studies and analyses in nations that have developed nuclear industries--that the human factor is always the weakest link of the chain. For instance, the few emergency incidents at nuclear power plants occurred because of human failures rather than because of technological breakdowns. For this reason, most efforts are concentrated on improved training. For instance, a major part of training programs now is simulation of several simultaneous failures of a nuclear facility. The future operator, therefore, will be much better prepared for fast and appropriate decisionmaking on the job.

[Question] Are we also preparing new training systems of a high degree of sophistication?

[Answer] Yes. We want to create in Gdansk, at the Polytechnical Institute, such a simulation facility. The plan is to organize it as a joint international project, primarily with the GDR and Czechoslavakia. Since the first stage of our nuclear plan will be ready by 1989, we have little time to train personnel at the highest level, although this is ultimately crucial for safe operation of the facility. This time, therefore, should be used in a rational way, making all the necessary preparations.

[Question] Nuclear energy production is a new area that we are just entering. You have mentioned, however, that we have already seen major achievements in manufacturing various kinds of equipment and apparatus.

[Answer] The Polon enterprises, which embrace several plants, experimental factories and research institutes, are producing annually equipment of a total worth of some 5 billion zlotys. About a half of this output is made for export. The main consumers of equipment and isotopes generated by two plants in Swierek are the health service field and industry. Our first manufactured item is equipment for medical diagnosis. One of the latest items is the so-called radioimmunological unit, and our greatest accomplishment is a piece of equipment for the treatment of oncological diseases, the so-called accelerators.

[Question] At a session of the Commission for Scientific and Technological Progress of the Sejm, Professor T. Koszarowski, Director of the Oncological Institute, complained that most of these products end up abroad ...

[Answer] A portion of these units is indeed intended for export. The first items of this kind were manufactured on the basis of documentation from the French firm, CGR-Mev, so we went into a debt that has to be repaid, mainly with ready-made products. We have also started export to socialist countries, and it is true that domestic needs have not been fully met in this area. The problem is that the first manufactured units were associated with considerable spending of foreign exchange, largely imported parts. Had we given them to our health service industry, we would soon have been blamed that we were supplying equipment to which most of the spare parts have to be bought with foreign exchange (something that the health services do not have in large amounts), so that the accelerators would soon be immobilized. As we develop our production, the need for foreign exchange spending diminishes, and within two years it will become minimal. Besides, we are now developing a new line of equipment for health services that will greatly increase our contribution to the treatment of oncological diseases.

[Question] In March 1983 the Council of Ministers decided to develop the production of equipment for nuclear power plants. This places new requirements on the enterprises controlled by your agency, as well as on the research facilities. Are these concrete developments, or are they just projects?

[Answer] Some things are quite concrete. The enterprises of Polon in Sluzewiec are already producing control systems for nuclear power plants. The first will be ready in September and is intended for export to Czechoslovakia. Another project being carried out at factories in Bydgoszcz and Zielona Gora is a dosimetric system of the entire circulation of an electric plant, which consists of electronic devices indicating the radiation level at some 1,000 sites of a nuclear facility and its surroundings. The first such system will be ready by mid-1984.

[Question] Also for export?

[Answer] At this point, our main assignment is export to CEMA countries, because manufacturing various nuclear facilities is becoming our specialty in the framework of this organization. But, obviously, as domestic needs increase, we will meet them, too.

[Question] Legal regulations and development of the output of nuclear equipment and plants are two spheres of the agency's activities. The third sphere is scientific research facilities. They have undergone a profound reorganization, especially the Institute of Nuclear Research. What was the purpose of this?

[Answer] The Institute of Nuclear Research until recently was the largest scientific institute in the country, employing 4,000 people. In the 1960's and the first half of the 1970's, it played a major role in developing the basic and applied nuclear research. Over time, however, the extremely broad subject spectrum and the unavoidable internal frictions have diminished its efficacy. Already by 1977, the interministerial commission appointed by the then minister of science, higher education and technology, Professor S. Kaliski, came up with a highly critical opinion on the work of the institute. Since then, its efficiency has been further declining. We have therefore come to the conclusion that this "giant" in its present form is incapable of growing or maintaining itself in the conditions of the economic reform, and that its huge intellectual, technical and productive potential cannot be used properly to solve problems important for the nation. The fact is that institutes currently are expected to have economic justification for their existence. This happens all over the world.

For this reason, the institute was transformed into three institutes, according to the specifics of research that was already conducted in its framework. The Institute of Nuclear Chemistry and Technology is concerned specifically with direct use of ionizing radiation and nuclear technology in various subsectors of industry--chemistry, metallurgy, mining, power engineering and machine building. These are strong economic foundations that would support this institute. The Institute of Atomic Energy will be concerned with problems involved with building of nuclear power and heat plants—especially the safe operation of these facilities. Having drawn up the balance sheet--making a list of what we have and have not--we found a lot of gaps. The institute is therefore to work on modernizing these systems for nuclear plants that we are beginning to produce. Changes in

this area occur so rapidly that the systems currently developed may be obsolete by 1990. Its third assignment is production of isotopes. As to the Institute of Nuclear Problems, it has launched a set of scientific, methodological, technological and production projects generally aimed at meeting the needs of medicine and industry for accelerators of charged particles. This is an economically effective area of the nuclear industry, meeting important social needs. For this reason, it has been assigned priority in the activities of the State Atomics Agency.

[Question] Are our nuclear research facilities well prepared to meet all their assignments? One commonly hears complaints about underinvestment in research facilities.

[Answer] We are in no better state than anybody else. The "Ewa" reactor, which is celebrating its 25th anniversary, requires thorough modernization. The other reactor--"Maria"--lacks important equipment, and the Krakow Institute of Nuclear Physics has been too slow in modernizing its cyclotron. In the 1970's, no investment was made in nuclear industries, and now we are bearing the consequences of this fact. Certainly, we do need means for modernization and development of research and production facilities. Partially, to the extent it can, the government is helping us. However, the new modernization of research and development units allows us to rely above all on our own capacities. The institutes have experimental production plants and the chances for turning up money for further development of the nuclear industry, despite complaints, are great. We are already taking part in implementing government programs and contacts, but the potential is much broader. I am not offended by Professor Koszarowski's criticism. I would prefer to hear more such comments, because it proves that the public needs our work. The new organization of nuclear research and development units, adapted to the economic conditions in our country in the 1980's and 1990's, creates real possibilities for developments. It is up to nuclear workers themselves whether they will be able and willing to develop this potential.

[Question] Thank you for the interview.

9922
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CNEN HEAD SAYS NUCLEAR PROGRAM WILL CONTINUE AT SLOW PACE

Rio de Janeiro O GLOBO in Portuguese 30 Jul 83 p 20

[Text] The chairman of the National Nuclear Energy Commission (CNEN), Rex Nazare, said in the War College (ESG) yesterday that the Brazilian nuclear program has already been reduced and adapted to the country's financial situation and together with other sources, will continue at a slow pace to guarantee the security and independence of the energy supply.

Rex Nazare explained that Brazil has large reserves of uranium to produce nuclear energy and it is going to continue to invest in that sector to reduce its dependence on oil imports. He observed that Brazil does not have problems of lack of energy today and can indulge in the luxury of drastically reducing investments in the nuclear area and in the construction of hydroelectric plants but without thinking of abandoning those activities because of its commitment to the future.

Rex Nazare said also that the difficulties Brazil is facing today in buying oil and those it has already had in the recent past because of the wars in the Middle East and the sharp price increases show that the best route is still to try to gain energy independence, using the resources available in the country: hydroelectric energy, alcohol and uranium.

8711
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CONSTRUCTION OF IGUAPE-I, II NOT TO BEGIN UNTIL 1985

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 5 Aug 83 p 26

[Text] Brasilia--The president of the Brazilian Nuclear Corporation (NUCLEBRAS), engineer Dario Gomes, revealed yesterday that the civil works of the Iguape-I and II nuclear plants in Sao Paulo will not begin until 1985. The dates envisaged for the operation of the plants--1991 and 1992--may be extended next January when NUCLEBRAS will reevaluate its projects timetable based on the investments to be approved by the federal government, according to the president of that corporation. The construction of the two Sao Paulo nuclear plants, therefore, will be delayed 2 years with reference to the projects timetable of the former president of NUCLEBRAS, Ambassador Paulo Nogueira Batista.

Dario Gomes revealed that NUCLEBRAS will open public bids to contract the Iguape-I and II projects at the end of next year, but next year only infrastructure work will be begun, with the construction of access roads to the site and grading. The civil works of Angra-III will also be begun next year. According to Dario Gomes, the work of preparing the bed site for the Angra-III project will be begun at the end of this year. The operation of that plant is scheduled for 1990 but it can also be postponed until the beginning of 1994.

Loan

The president of NUCLEBRAS is going to West Germany at the end of this month to contract a new loan of $80 million from a consortium of German banks headed by the Deutsche Bank. This is the second loan intended for the nuclear program taken by NUCLEBRAS in Germany this year. The first was signed on 29 June for the same amount of $80 million.

Commission

Dario Gomes will leave for the United States tomorrow in order to participate in the second meeting of the Brazil-U.S. Nuclear Commission created last year when President Ronald Reagan was in Brazil. At this meeting, the commission will conclude the terms of the report to be presented to the presidents of Brazil and the United States. According to Dario Gomes, an analysis will also be made of the possibility of reactivating nuclear cooperation between the two countries.

Dario Gomes anticipated that the Brazil-U.S. commission will offer prospects of agreement for nuclear training in the area of the National Nuclear Energy Commission (CNEN); he pointed out that the prospects are more in the area of the CNEN rather than of NUCLEBRAS inasmuch as that company has already defined its program on the basis of the agreement signed with Germany in 1975 for the construction and installation of the reactors and the whole fuel cycle.

Dario Gomes practically discounted the possibility of a solution emerging from that commission to the agreement thus far not fulfilled by the United States, under which that country would supply enriched uranium for the recharges of the first Brazilian nuclear plant of Angra-I, emphasizing that "conditions have not changed."

That is, the United States is prohibited by law approved by its congress from supplying nuclear fuel to the countries that did not sign the "nuclear nonproliferation treaty" and Brazil, for its part, remains determined not to sign it.

8711
CSO: 5100/2085

PROBLEM DURING RECHARGING OF ANGRA-I SAID TO POSE NO DANGER

Rio de Janeiro O GLOBO in Portuguese 2 Aug 83 p 20

[Text] The director of thermonuclear production of Furnas, Luis Cals, told O GLOBO yesterday that the problem that occurred at the Angra-II [sic] plant at the time of reloading the nucleus with fuel did not represent, nor does it represent, any danger to the plant facilities or the environment.

The problem occurred when a rod assembly of rods containing enriched uranium pellets shifted from the normal position. The technicians then decided to withdraw the assembly, also called fuel element, transferring it to the pool where the spent material is collected. The operation of withdrawing the pellets was conducted with absolute safety; there was no type of contamination.

Common Problem

Luis Cals said that recharging will continue tomorrow so that the plant can enter into commercial operation. Asked about the possible recovery of the assembly of radioactive rods, the Furnas director said that the material will be inspected in the future and that the final word will be left up to the specialists. Cals said that problems of that type are common and there is no reason for concern.

The activities of Angra-II [sic] have been paralyzed for several months so that Westinghouse technicians could repaid defects in the steam generator. That work had already been completed when the reloading of fuel elements began.

Furnas disseminated the following note:

"During the operation of reloading the nucleus of Angra-II [sic] with fuel, one of the fuel elements shifted laterally, resting on the wall of the reactor vessel.

"That element was immediately withdrawn to be replaced by one of the available spare elements. The recharging operation will be resumed next Wednesday (tomorrow).

"The incident did not cause any release of radioactivity into the containment vessel or into the environment, therefore, it did not affect the safety of the facilities, the operators or the public.

"Angra-I is still turned off and will resume operational tests immediately afterwards."

8711
CSO: 5100/2085

INTERNATIONAL CONFERENCE ON HYBRID NUCLEAR REACTORS DISCUSSED

Karachi DAWN in English 12 Aug 83 pp I, IV

[Article by Azim Kidwai]

[Text]

Nathiagali Summer College now appears like a misnomer, since this high-level intellectual activity has been transported on to the plains. This extended seminar of three-week duration is now held in the high summer temperatures of Islamabad instead of the invigorating, cool and lofty heights of Nathiagali (height: 8,000 feet). Nevertheless, the flywheel effect, or what the physicist may like to call inertia, has prevailed, and the PAEC (Pakistan Atomic Energy Commission) that gave birth to the institution eight years back, prefers to stick to its original pre-fix "nathiagali".

The "Eighth International Nathiagali Summer College on Physics and Contemporary Needs" (that is its full name), held from July 23 to August 11, was as invigorating as in the past, the sultry Islamabad weather notwithstanding; perhaps the hot and close, oppressive weather got diluted as the very courteous PAEC team looking after the foreign participants, escorted the crowd to Nathiagali for two days for the first week-end.

That did help in rejuvenating the overworked body and the brain cells and gave them a feel of what scenic beauty engulfs some of the mountains in Pakistan. I could overhear some of them in the bus comparing it to Switzerland!

World authority

The Summer College invites about a score of first-rate scientists from abroad to lecture at the sessions, apart from scores of participants; but there are always one or two of the class of Nobel Laureates or F.R.S. (Fellow of the Royal Society) to impart glamour to the occasion.

For instance, this year one could spot Dr. F.R. Farmer of U.K., a world authority on risk assessment and reliability engineering. He is an ex-Adviser to the United Kingdom Atomic Energy Authority. But in my opinion, the man who stole the show at the Eighth Summer College was a rather young Turk, Dr. Sumer Shahin, who works at Lausanne, Switzerland.

Dr. Shahin in his series of lectures unfolded the concept of hybrid reactors — reactor complexes exploiting fusion phenomenon (the reaction in the hydrogen bomb) to provide fuel for the present-day fission reactors. His group in Switzerland has worked out the contours of such fusion-fission hybrid reactors. A lay person could perhaps visualize that nuclear fabric, as if, both hydrogen bomb and the atomic bomb, have been tamed in an integrated shape for gradual release of energy for peaceful purposes.

The small multi-national group, comprising a Swiss, a Turk, a Frenchman, an Indian, an Algerian, two Americans and one Afghan scientist, has been able to design the configurations of such reactors, and worked the physics lying behind them. The group is supported and sustained by the Swiss Government.

Discussing the rather tantalizing prospects of such systems with Dr. Shahin after his second lecture, I could gather that such a fuel factory and the power generating mechanisms should be possible by the end of the century. The systems could be commercially available in the early years of the 21st century.

Why hybrid reactors at all? Why not breeder reactors that can produce more nuclear fueld than they consume? I asked Dr. Shahin. The breeder reactors could also act as nuclear factories; these are already working as prototypes or as experimental systems.

Because the breeders cannot supply the requisite large inventory of nuclear fuel to the present-day thermal reactors for another fifty years or so, said Dr. Shahin.

Critical

He said the energy situation in the next two decades is going to turn very critical. The prototype breeder reactors in operation or under installation in some countries will not be able to supply fuel to the reactors, while uranium will be getting scarce.

His argument was, and a convincing one at that, that the doubling time of the first commercial breeders will be 20 to 30 years. He gave the example of the largest breeder reactor, to be completed in 1984:

the 1,200 MW French demonstration breeder, Super Phoenix, will have a doubling time (of fuel) of about 50 years.

The smaller British and American breeders reflect the same pattern. That means to run the power reactors being installed and being planned around the world, including Pakistan, will be a real problem in the first half of the 21st century, uranium deposits gradually getting depleted.

The constraint comes because over 99 per cent of the uranium dug out from the crust of the earth is not fissionable. Called Uranium-238 (U-238), this isotope of uranium cannot run the nuclear reactors (nor can one use it to produce the bomb). Only less than one per cent of the uranium (to be exact, 0.7%) is fissionable. This less than one per cent (the isotope is called Uranium-235 or U-235) is the real meat that produces energy in the nuclear reactors as it fissions (splits).

The uranium bombs are also produced from U-235. The natural uranium fed in KANUPP (Karachi Nuclear Power Plant) as fuel is of the same complexion: over 99 per cent not producing any energy; only less than one per cent as agent of energy production.

However, the bulk component, U-238, is not a useless material. As it is lying in the area where U-235 is fissioning, just a little of it going into transformation. The new element born is known as plutonium. And, lo and behold, this new man-made element, plutonium, is also fissionable, and as good a meat as Uranium-235.

You can run nuclear reactors from plutonium; you can make a bomb from plutonium. The Nagasaki bomb was a plutonium device; so was the one blasted by India in 1974.

But the plutonium produced in the power plants like KANUPP is very little, only a fraction of the uranium that produces the energy in the reactor. Here come the reactors known as breeders, though they are not yet commercial and are only in an experimental stage.

Unlike the power reactors now in vogue, a breeder reactor duplicates the physics of the bomb. In the process, it produces more of plutonium. Thus in a breeder reactor you are producing more of nuclear fuel than it actually consumes. In the end, therefore, you have more of nuclear fuelthan what the reactor has consumed. That is the beauty of the breeder reactors.

However, the surplus of nuclear fuel (plutonium) from the first breed of breeder reactors will not be enough. The breeder technology has gone by default, and commercial breeder reactors are yet not in sight due to various reasons.

Dr. Shahin's concepts and the work of his group should help in getting over the nuclear fuel crisis in the next century.

Constraints

The breeder reactor scene is a very complicated one, and I didn't discuss it with Dr. Shahin. Nevertheless, its relevance is great in the context of the proposed hybrid reactors. There have been three main constraints in developing the breeder reactors:

1. The political implications of the breeder reactors: if the breeder reactors get galore, plutonium would gradually be galore in this world. The Carter administration in the USA was scared of the proliferation aspect of nuclear fuel, and put constraints on the R&D (research and development) of the breeder programme. It is still in a low key in the USA.

The French and some other European nations are more keen to develop commercial breeder reactors. The R&D effort, however, requires large sums of money that none is prepared to spend.

2. The cost of a breeder reactor is still about 50 per cent more than the traditional reactor. Most countries are thus not prepared to go for them in a big way.

3. The breeders are a variety that carry more risks for the population around in case of accidents, and the environmentalists and the anti-nuclear lobby are violently against them.

It is thus very likely that commercial breeder reactors may not be on the world scene for long. In such a situation, the work being done by Dr. Shahin's group may gain much more importance.

The main problem in developing the hybrid reactors whose blueprints are being worked out by Dr. Shahin and his group will be the fusion part of the complex. Through hydrogen bombs, which are based on fusion reaction, have been successfully developed and tested, the fusion reaction could not be tamed in any of the experimental machines, so far.

Fusion reaction requires temperatures that prevail in the sun and the stars. The hydrogen bomb is triggered by a uranium bomb that can produce such high temperatures. But producing temperatures of the order of 100 million degrees or so in a machine and keeping the plasma thereafter stable is no easy task.

So far, promising work on fusion has been done, and is in an advanced stage, in the USA, Russia, Japan, Germany, Argentina, and India. Nevertheless, no fusion reactor (a tamed H-bomb) has been built so far; it is still far off; may be the reactor releasing energy by fusion is not on the scene upto the middle of the next century.

The hybrid reactors though seem to be feasible in the near future.

Heavy hydrogen

Unlike uranium, which is available in limited quantity over the globe, the fuel for fusion (being hydrogen) is almost unlimited. No doubt, it is not the ordinary hydrogen (the component of water) that is used in fusion reaction, but the heavy hydrogen, the heavier isotope of hydrogen. Its scientific name is deuterium, the symbol is D. However, D is also in abundant supply in all water when you consider the bowls of the ocean that cover three-fourths of the globe.

As heavy uranium atoms split and release nuclear energy, likewise the deuterium atoms fuse together and release nuclear energy (hydrogen bomb is one example). So, nuclear energy can be made available either through fission or through fusion.

Now, one litre of water (any water) can yield deuterium to produce fusion nuclear energy equivalent to 300 litre of petrol. So, one can imagine the treasure of hidden energy in water the world over.

Turkey and India are more interested in fission-fusion reactors because of a very special reason: Turkey has the largest reserves of thorium in the world, while India also possesses one of the largest reserves of thorium. And, thorium is yet another element like uranium that can breed nuclear fuel and can thus yield an abundant supply of nuclear fuel. (While Uranium-238 breeds plutonium, thorium breeds an isotope of uranium which is as good a nuclear fuel as plutonium).

Different ways

Dr. Shahin discussed five different ways of making the fusion reaction feasible for the hybrid reactors:

1. Magnetically confined fusion reaction of the Tokamak type, first invented in Russia.
2. Fusion reaction through laser beams, under development in the USA, Russia, Japan, India etc.
3. Muon catalyst fusion, using an accelerator as tool to produce muons. Instantaneous fusion can take place in this system even at room temperatures.
4. Plasma focus device in which electrical discharge is focussed on a point to produce fusion. Small machines can be built on this principle.
5. Impact fusion. In this, macro-pillets are accelerated to very high velocities to hit the target.

Number 4, in Dr. Shahin's view, holds the greatest promise.

Once a reliable fusion machine is available, it may not be difficult to build a hybrid fusion-fission reactor system. The fusion chamber could have a blanket of Uranium-238 or thorium. Out would come plutonium or Uranium-233. Both can be used in the present-day power reactors as fuel. High fission fuel production could thus be made feasible.

The first nuclear fuel factories of 1000 MW capacity are envisaged by the close of the century, providing nuclear fuel for 20 to 40 of present day type power reactors of equivalent power output.

Educated in Turkey, Germany, and the USA, Dr. Shahin was of the firm view that if hybrid reactors cannot penetrate the market by the turn of the century, there will be significant nuclear fuel shortage.

The 41-year old handsome Turkish scientist showed great optimism in the hybrid reactors his group is trying to develop in Switzerland; and Turkey would benefit the most with its vast thorium deposits when such reactors get commercial.

CSO: 5100/4727

BRIEFS

PLEA TO SHARE TECHNIQUES--Islamabad, Aug 10: The Chairman, Pakistan Atomic Energy Commission, Dr Munir Ahmad Khan, today asked the advanced countries to share their knowledge and techniques with the Third World. He was speaking at the concluding session of "Eighth" International Summer College on Physics and Contemporary Needs". The College which was organised by Pakistan Atomic Energy Commission was attended by 200 noted scientists and engineers from all over the country and abroad. Dr Munir asked foreign participants to persuade their governments to assist the Third World countries in their scientific programmes. He also asked the Third World countries to forge co-operation among themselves for the promotion of science and technology. He said students of science in various universities in the country would be invited at the next Summer College to enable them to exchange scientific knowledge with international scientists. [Test] [Karachi DAWN in English 11 Aug 83 p 4]

CSO: 5100/4727

BRIEFS

UCOR TRAINING CENTER--The Minister of Mineral and Energy Affairs, Mr Piet du Plessis, has warned that South Africa will have to depend more and more on specialist training if the country wants to pace with the rest of the world. Speaking at the opening of a new Uranium Enrichment Corporation training centre Mr Du Plessis sand the training centre at Ocur was a signpost for the rest of the South African industry. "We spent more than R7.5-million on the construction of this centre and it will have some of the most modern equipment in the country," Mr Du Plessis said. Training at the centre will be given in 10 different technical directions and about 300 apprentices will be trained annually. Mr Du Plessis said what made the training centre unique was a system in which each apprentice is supervised by one person during the entire four years of his training. He said Ucor had at first to make do with personnel trained by other companies, but that it soon became clear that the kind of technology required by Ucor personnel called for specialist training. "Ucor had to train people to standard previously unknown in South Africa, because of the high quality of products Ucor needs. He said the average industry in South Africa could not provide goods of the quality needed, even though quality control in South AFrica was as good as in any other country. "A country can have the best researchers and engineers, but without properly trained technical men it will be impossible to make any technological advances," Mr Du Plessis said. [Text] [Johannesburg THE CITIZEN in English 22 Aug 83 p 13]

CSO: 5100/52

WORLD'S FIRST UNDER SEA-BOTTOM N-WASTE FACILITY DESCRIBED

Stockholm DAGENS NYHETER in Swedish 22 Aug 83 p 56

[Article by Owe Nilsson]

[Text] Forsmark, 18 Aug--Work on the world's first nuclear waste storage facility beneath the ocean floor has now begun in earnest, after all the permits were obtained and all the appeals exhausted. At the farthest point of Stora Asphallan, a windswept island in Oregrundsgrepen, an Akerman H-25 has been methodically digging down to bedrock for the last few weeks.

Trucks loaded with debris from the excavation come and go with as monotonous regularity as the rain falls. In the background, Forsmark's two nuclear power plants loom up like two colossal cigarette packages with a cigarette sticking out of each one.

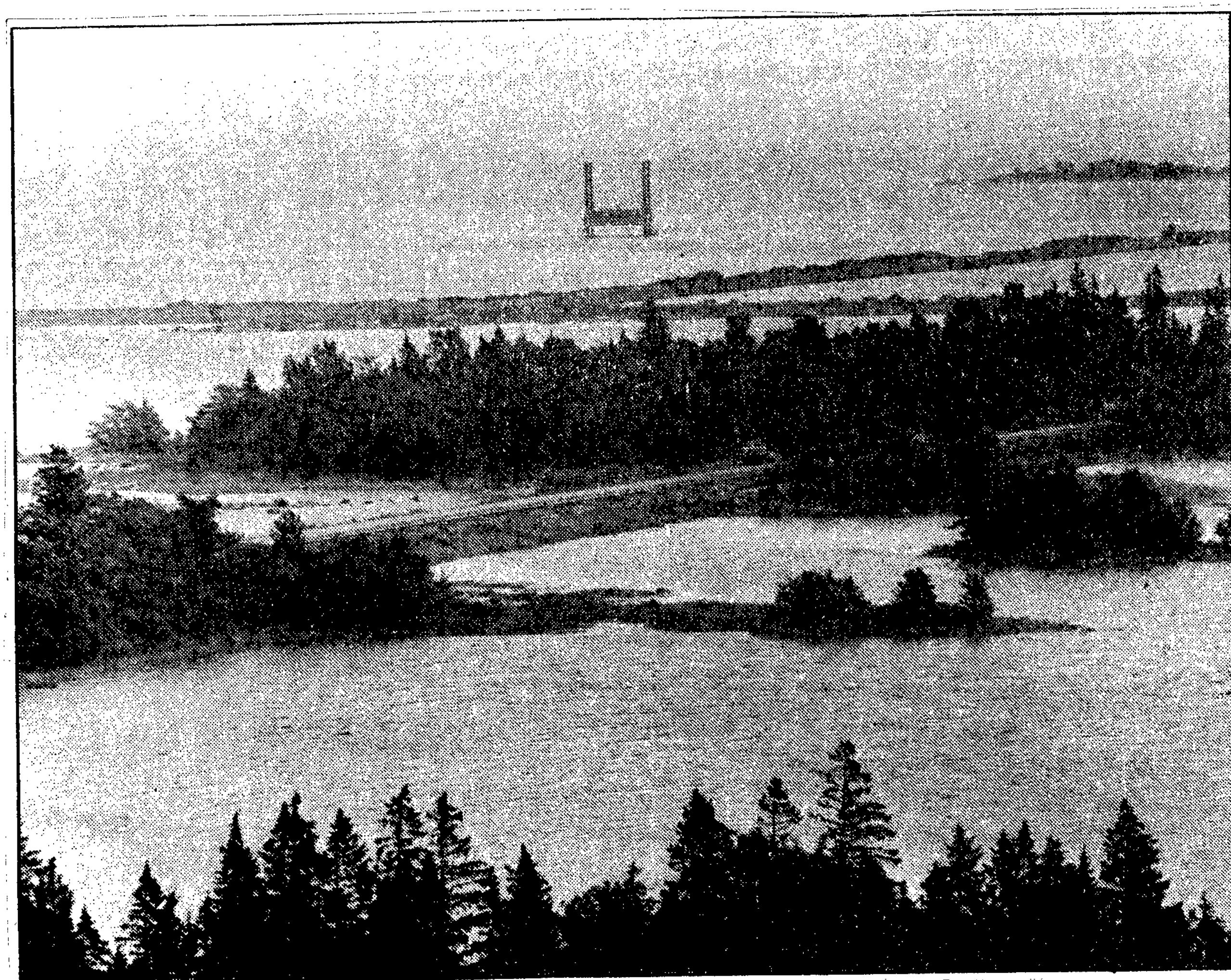
At some time in the future ashes from these plants will pass through the opening the excavator is digging, go through a tunnel about a kilometer long and end up in a cave in the rock 50 meters below the ocean floor to remain there for all eternity. When the facility is full, it will be sealed up and abandoned.

Rock-solid final preservation, in other words. But there are divided opinions about how long eternity will last and how solid the rock is.

The project has been given the name of SFR, Final Storage of Reactor Waste, and is led by the Swedish Nuclear Energy Development Commission, SKBF, one of the nuclear power industry's jointly-owned companies. Hydroelectric is doing the work. An average of 75 men will be employed for at least 4 years, with a maximum of 250 men working in the final phase.

Rock Caves

In addition to a transport tunnel 1400 meters long and a construction tunnel of equal length, three 160-meter long rock caves and four cylindrical containers will be blasted out of the bedrock. Each space will be 60 meters high and 30 meters in diameter, in other words almost two Katarina hoists could fit into the height of each space.



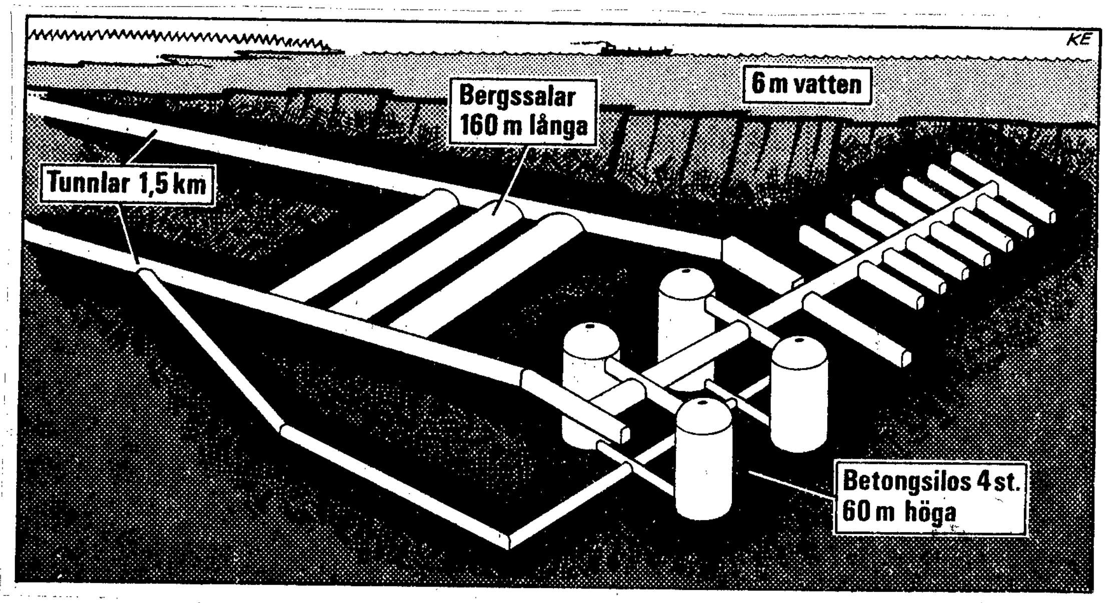
On a windswept island in Oregrundsgrepen, work on Forsmark's waste storage facility has begun in earnest. The low- and medium-active waste from all 12 of the country's nuclear reactors will be given final storage here, 50 meters down in bedrock, 1.5 kilometers out to sea. But there are divided opinions as to how long forever will be.

In each cavity a 50-meter-high cement silo will be poured. Internally the silos will be shaped like beehives with compartments 2.5 meters square from bottom to top.

Here is where it will stay. All low- and medium-active waste in the form of filter material, discarded components, insulation material and protective equipment from all 12 of the country's nuclear reactions.

In contrast to highly-active waste that is caused in the course of nuclear fission itself, this waste has a "short" lifetime. After 500 years, the amount of activity is comparable to that in topsoil, according to SKBF.

From the point of view of construction technology the project is something entirely new. No one has done anything like it before.



The illustration shows how the waste facility under the ocean floor will look. Each of the four rock caves will be 60 meters high and 30 meters in diameter, in other words each space is high enough to contain almost two Katarina hoists.

Key:

1. Tunnels, 1.5 km
2. Rock caves, 160 meters long
3. Water, 6 meters
4. Four cement silos, 60 meters high

"The biggest problem will be to pour the silos. We do not have very much experience to go on," said Leif Lagerstedt, section chief at Hydroelectric, as he tried to keep the wind from blowing away his sketches as we stood on Store Asphallan in front of the planned tunnel entrance.

"Another problem will be to get the Bentonite clay between the silos and the rock walls to fit tightly," he said.

Barriers

The clay is the most important barrier. The others are the cement packages in which the waste is sealed, the cement silos and the bedrock.

If too much radioactivity escapes even so, it will be an advantage to have this happen in large quantities of water, according to SKBF. It is expected that radioactivity will be released. The barriers are not intended to prevent leakage, but to slow it down. But it will be released over such a long period of time and in such small quantities that it will be harmless, according to SKBF.

In the first phase, two of the silos will be built. They will be ready for trial storage in 1988. Ten years later the other two will be put into operation. A total of 100,000 cubic meters of waste will be stored there.

In the third phase, several decades into the next century, SKBF hopes to add on for the demolition waste from the reactors which will then be torn down, which would involve another 150,000 cubic meters.

When everything has been deposited, the facility will be filled up again with cement and abandoned. The buildings on the shore will be torn down.

Reservations

The State Nuclear Power Inspectorate, SKI, has approved the facility with certain reservations. Among other things, it is said that the location beneath the ocean floor will complicate evaluations of the facility's function and make it difficult to supervise after it is sealed off, in comparison to a facility located on land.

SKBF does not feel this is a relevant objection.

"We have made the assumption that the facility can be forgotten and no controls will be needed," said Hans Forsstrom of SKBF.

Nor does SKI feel the choice of site is ideal from a geological viewpoint. There are a good many cracks and several zones of weakness in the bedrock, among them the so-called Singo line, where two different types of rock meet.

In his report, SKI's consultant, Owe Stephansson, a professor in the mechanics of rock structures, recalled the problems that arose when the two

cooling water tunnels from the reactors were being built. While work was in progress on one of them, 200 cubic meters of rock fell from the ceiling and it was not until "extraordinary reinforcement efforts" were made that it was possible to get past the zone.

At SKBF they said it was certainly no problem to find better rock.

Retention

"But we are not counting on the bedrock in evaluating safety, other than for a 10-year retention period," said Hans Forsstrom. "The important thing is that it can be used for building and we have determined that it can."

The People's Campaign is opposed to having the facility located under the ocean floor at all. The group refers to a scientific study an American biology professor made of the so-called NEA report, which was presented at a London conference in which Sweden and other countries participated.

The NEA report stated that dumping low-level waste did not represent any danger to the marine environment. The study of the report, however, said that the ocean is the least desirable of all storage sites for radioactive waste. Among other reasons because the ocean environment has been so inadequately studied and because it is virtually impossible to find the waste again.

Protests

On Graso, which is a few miles away from the Forsmark storage site, lives Maj-Britt Andersson. She is the most active participant in local protests.

"How can they say that the barriers will hold for hundreds of years? When the facility is shut down and the pumping stops, it will fill up with water within a year and then it is just a question of months before the water reaches the nuclear waste and leakage begins," she said.

"It is quite correct that this would take only a few months," said Hans Forsstrom, "but the amounts involved are negligible. Comparing waste dumping with the Forsmark storage facility is like comparing ants and elephants. Every year more is dumped than we will store in the facility in all."

But what will be done if there is a big leak? How can we get down to the facility if it is sealed with cement?

"It is theoretically possible, but in practice it is not," said Hans Forsstrom. "That is why we must make sure that this will not happen."

No Alternatives

The People's Campaign says this is unsatisfactory. The government was wrong when it approved the proposal without looking at any other alternatives. Land-based storage at each reactor site, for example.

"That would be more expensive and there would not be any advantages in the way of safety," said Hans Forsstrom.

There are several reasons why SKBF wants the storage facility beneath the ocean floor.

"The philosophy in Sweden and the rest of the western world is that one can abandon the storage sites," said Hans Forsstrom. "This means that no one in the future could drill into the storage facility by mistake.

"In the second place, if something should happen, it is better that the waste leaks out into as large a quantity of water as possible."

No special calculation has been made of the consequences a leak would have on animal and plant life in the ocean. But studies have been made of emissions from nuclear power plants and of the residue from bomb tests. The Environmental Protection Agency said that the Forsmark storage site did not represent any danger from the point of view of radiation.

It is estimated that the costs of the storage facility will be 1 billion kronor in terms of 1981 values, including 30 years of operation. The People's Campaign says the figure will be three times that.

At Hydroelectric they say that if the waste is sealed in asphalt, so-called bitumen, the volume of the storage facility must be expanded, which will cost money, said Leif Lagerstedt of Hydroelectric against the roar of the excavating machinery.

6578
CSO: 5100/2630

ENERGY MINISTER SEES DEMISE OF NUCLEAR ENERGY IN 25 YEARS

Stockholm DAGENS NYHETER in Swedish 15 Jul 83 p 7

[Text] "The decision reached through the referendum and by Parliament concerning nuclear power will remain in force. The time frame of about 25 years for the operation of nuclear power plants still holds. This has not been changed by a special plea from the SKBF (Swedish Nuclear Fuel Supply Company)."

That is what Minister of Energy Birgitta Dahl told the TT [Press Wire Service, Inc.] in the debate over the service life of the nuclear power plants.

The nuclear power plants are to be closed down gradually through the year 2010 according to the referendum and a decision by Parliament. The intention has been that each plant would operate for 25 years, but the SKBF is now planning to let all the nuclear power plants run for their full life. In the case of Oskarshamn I, that means nearly 40 years.

Those plans have stirred up the People's Movement Against Nuclear Power and the Center Party, which are asking the government to make a statement. The government's position is clear.

Birgitta Dahl says: "The Social Democratic government is completely committed to compliance with Parliament's decision. If Parliament's decision is to be changed, it will have to happen after decisions are made in the government and in Parliament. No individual contribution to the debate can change it."

Birgitta Dahl is therefore calling the SKBF's plan a "contribution to the debate" and a "special plea."

She adds: "But there is no basis for any absolutely certain assessments concerning the service life of the nuclear power plants. This is true both generally and as regards the individual power plants themselves."

Exactly how the phasing out will take place is now being studied by the 1981 Energy Committee. It will submit proposals to the government next fall in preparation for the 1985 energy decision. Not until then will the government take a stand on whether there should be any change in the service life of the nuclear power plants.

The SKBF's views appeared in "Plan 83," an annual report that discusses, among other things, what waste disposal will cost in the future. This year's plan says that the cost will rise from 32 to 43 billion kronor due to the higher quantities of waste that will result from the longer operating lives of the plants.

Nuclear Fuel Board To Be Overhauled

The activities of the Board for Spent Nuclear Fuel are to be overhauled. According to the TT, the government decided on Thursday to issue instructions to a committee for the overhaul.

The nuclear fuel board has existed for several years, and the time has come for an evaluation of its activity. Among other things, the committee is to decide what information on research the board should have. The boundaries between it and other agencies are unclear.

Studsvik Gets Okay From Government

On Thursday the government approved a proposal by Studsvik Energy Technology concerning modernization of radioactive waste treatment at Studsvik. Studsvik will build a new facility for the treatment of medium-level waste and a new interim storage facility for low- and medium-level waste, according to the TT.

11798
CSO: 5100/2622

WESTINGHOUSE AGREES TO PAY FOR REBUILDING AT RINGHALS III

Stockholm SVENSKA DAGBLADET in Swedish 8 Jul 83 p 7

[Article by Dag Bjerke]

[Text] The American Westinghouse Corporation, which supplied the steam generators for the Ringhals III and Ringhals IV nuclear power plants, will pay for rebuilding those generators.

This was settled through an agreement reached between the State Power Board and Westinghouse on Tuesday.

In the case of Ringhals IV, it was clear from the start that the American firm would pay the rebuilding costs because the guarantee was still in force when the defects were discovered.

The situation with Ringhals III was considerably more complicated.

Because of the referendum and the resulting political turns, the guarantee period had expired before the reactor went into operation and the defects were discovered.

Despite that, Westinghouse has agreed to pay the rebuilding costs at Ringhals III as well.

"Of the 15 reactors around the world, Ringhals III was the only one with steam generators causing trouble after the guarantee period had expired. So Westinghouse was in no danger of having to pay for a lot of other unguaranteed rebuilding just because it yielded in the Ringhals III case," says Ingvar Wivstad, the State Power Board's technical manager, who handled the negotiations with Westinghouse.

Loss

The rebuilding cost for each nuclear power block is estimated at between 70 million and 100 million kronor.

But the State Power Board itself is responsible for the secondary costs incurred when it was forced in the meantime to produce electric power at other,

more expensive facilities. This involves a loss of about 350 million kronor for both blocks since the defects first appeared in October 1981.

The State Power Board will also pay a total of about 15 million kronor for certain additional reconstruction that the board itself has requested in this connection.

This involves inspection equipment making it possible to see how the steam generators work in the future.

For the State Power Board, this is essential so that it will be able to determine whether the rebuilt steam generators are operating according to plan. If they are, the responsibility can be shifted from Westinghouse to the State Power Board.

In addition, the State Power Board will pay for another item of reconstruction so that from now on, 20 percent of the flow of feedwater that caused the damage to the steam generators will be fed in through the tops of the cans.

The remaining 80 percent will then be fed in through the newly designed inlets. This will also reduce the danger of new damage to the pipes inside the steam generators.

Ingvar Wivstad says: "Certainly, we would like to have gotten a better agreement, especially as regards guarantee commitments for the future."

At Loggerheads

He says: "But it's a good thing that this is over. These negotiations have been very difficult and tough. It can well be said that we were really at loggerheads several times along the way."

New Nozzle for Nuclear Steam Generator

Preston Chrisp is the smallest member of a group of 25 repairmen from the United States who are currently working to straighten out the troublesome steam generators in Ringhals III's reactor. His small size makes him so suitable for the cramped job that he is already considered to have been "used up radioactively" for a couple of months to come.

Even so, the special team sent all over the world by the American nuclear giant Westinghouse to replace inlet nozzles in its total of 15 nuclear power plants with recalcitrant steam generators are not forced to expose themselves to drastic radiation levels.

During the 4 weeks that the Ringhals III reconstruction work has lasted so far, the little and truly capable Preston Chrisp has had to do most of the work in cramped quarters.

According to the meters he wears on his head and wrist and in his breast pocket while working, he has been exposed to a radiation dose of 8.6 millisieverts.

Bo Larsson, the State Power Board's official in charge of radiation protection during both the now-completed rebuilding in the fourth reactor and the current work on the third, does not like to see anyone receive more than 10 millisieverts over a 3-month period.

Acceptable Level: 20 Millisieverts

But Aaron Jen, Westinghouse's Taiwan-born boss on the reconstruction job, says that as much as 20 millisieverts is acceptable.

The absolute formal limit for workers in the nuclear power plant is set at 30 millisieverts per quarter.

According to Hartvig Gornandt, head of the Information Department at Ringhals, the radiation dose to which Preston Chrisp has been exposed corresponds to the risk of cancer that would result from smoking several hundred cigarettes at the same time or from living with the radon in the air of a Swedish home for a year.

Bo Larsson says: "We are nevertheless going to try to keep Preston Chrisp away from the job with the highest level of radiation exposure."

That job consists of squeezing one's head, arms, and upper body through the mouth of a 30-centimeter pipe and into the steam generator itself to set up the new spray nozzles.

No Answer

What Preston Chrisp himself thinks about his radiation dose or even about his well-paid--and possibly, from the radiation standpoint, dangerous--job as a world-roving steam generator repairman is something he is not allowed to talk about.

Boss Aaron Jen cut that conversation short: "Our people are here to do their job--not to answer questions."

It was in Ringhals III itself, in October 1981, that the problems with pipes cracked by vibration in some of Westinghouse's pressurized-water reactors were noticed for the very first time.

Leaks were found between the radioactive water inside one of the three steam generators' more than 4,600 pipes and the feedwater that flows along the outside of the pipes to be heated up for boiling.

The water inside the pipes gets its 300-degree heat from the nuclear reaction inside the reactor core. As a result, it carries highly radioactive impurities away with it.

The steam from the evaporated water goes to the turbines, which then turn the electric generators.

It was discovered quite quickly that the leaks were caused by the fact that the feedwater--at a rate of 660 liters (about two bathtubs full) per second--was flowing in and striking the pipes nearest the inflow all too violently.

The pipes began to vibrate against the brackets holding them, with the result that holes developed.

The solution to the problem is considered to be the new spray nozzles which have already been mounted in the fourth reactor and which are now being placed in the third.

Similar spray nozzles have also been mounted in an American nuclear power plant that has gone into full operation. According to reports, they are functioning as planned.

Each reactor has three steam generators, each with an inlet. So there are a total of three feedwater inlets in Ringhals III that must be first have their old unusable spray nozzles removed and then be fitted with new ones using the "ship-in-a-bottle technique."

The man responsible for that work is the State Power Board's Olle Svensson. The question is whether he really has very much to do now that the Westinghouse gang has come flying in with 25 men and 80 tons of equipment and tools--all perfectly sorted out in a mass of big crates.

In the course of the work, the pipes--approximately 20 millimeters thick--are completely emptied of radioactive water. The moderate amount of radiation that the workers are nevertheless exposed to comes from radioactive products that have adhered to the inside of the pipes.

The radiation is reduced as much as possible by lead shields surrounding the steam generator in the work area and in front of the inlet opening itself.

The workers do not wear special radiation-proof protective clothing--it is not considered necessary. And the only clothing that could stop the gamma radiation in question here is lead clothing. If he were dressed in that, even the slender Preston Chrisp would not be able to squeeze into the narrow pipe.

11798
CSO: 5100/2622

APPROVAL GRANTED FOR FORSMARK PLANT TO BUILD WASTE STORAGE

Stockholm DAGENS NYHETER in Swedish 12 Jul 83 p 24

[Text] Construction of the Forsmark storage facility for low- and medium-level radioactive waste can now begin. The National Franchise Board for Environment Protection has given approval for the start of preliminary work on the structure even though the board has not dealt with the question of stipulations in connection with the facility.

The Swedish Nuclear Fuel Supply Company [SKBF] has requested what is known as startup approval--that is, permission to begin certain work immediately. The timetable for construction of the storage facility is tight, claims the SKBF, even though it is not scheduled for completion before April 1988. Failure to complete the facility on time may cost many millions of kronor, because storage capacity at the nuclear power plant will then have to be increased.

What the SKBF wants to do now is prepare the ground for the structures and provide the entrances leading down to the tunnels to the storage facility, which will be located under 50 meters of water in the Oregrund Inlet. The entrances must be ready before winter, since work, and consequently completion of the facility, will be delayed by bad weather.

Financial Reasons

The Franchise Board assigned considerable weight to the financial reasons for beginning construction now. Besides the risk of delay, finances may be affected by the fact that qualified personnel are now available at Forsmark. The construction of Forsmark III is now complete, and the work force will have to be reduced. If the start of construction is delayed, it may be difficult to recruit new personnel.

The SKBF is starting the work at its own risk. If the Franchise Board requires another solution for parts of the facility in its final decision, the SKBF will have to bear the costs itself.

Tommy Hedman, project manager at the SKBF, says: "This means that we can start immediately to get the ground ready. In August, as soon as vacations are over, we can get seriously down to work. We have already built some sea defense works that we had the go-ahead for."

To begin with, the project involves 1.5 years of work to construct entrances down to the tunnels and to do the tunneling itself. Only after that phase is complete--when the time comes to form the storage spaces themselves--will the SKBF run the risk of seeing the Franchise Board recommend new stipulations and other technical solutions. For the time being, Tommy Hedman regards that risk as an acceptable one.

He says: "The big decisions have already been made by the government. We have no reason to believe that this construction will be stopped or made subject to radically different requirements. We regard the Franchise Board's reservation as a formality. They have to make it clear that we are the ones chancing it if the requirements change."

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